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# Hemlock Sawfly

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The hemlock sawfly (*Neuroterus tsugae* Middleton) is an important defoliator of western hemlock in southeastern Alaska and the coastal area of British Columbia, Washington, and Oregon. It also occurs in the interior of British Columbia, and in Montana and Idaho (fig. 1).

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## PROCUREMENT SECTION CURRENT SERIAL RECORDS

Most outbreaks of the sawfly collapse with little or no tree mortality unless it is feeding in association with other defoliators, particularly the black-headed budworm (*Acleris gloverana* Walshingham). Since the sawfly prefers old foliage and the budworm prefers new, their feeding together may result in complete defoliation.

### Host Trees

Western hemlock is the primary host of the sawfly, but conifers of several other species may be defoliated if they are in the vicinity of infested western hemlocks. These species include Sitka spruce, mountain hemlock, and Pacific silver fir.

### Evidence of Infestation

Young sawfly larvae usually feed in colonies (fig. 2). Two or more larvae often feed on the same needle, starting from the tip and feeding back to the base. Frequently the center rib is left by the early-instar larvae. Immature larvae feed only on old foliage, but maturing larvae will attack new foliage if all of the older foliage is depleted.

As the sawfly larvae mature, they tend to become less gregarious and often feed singly, but some feed in colonies until they pupate. High populations of the sawfly may remove all of the older foliage. This makes the tree crowns

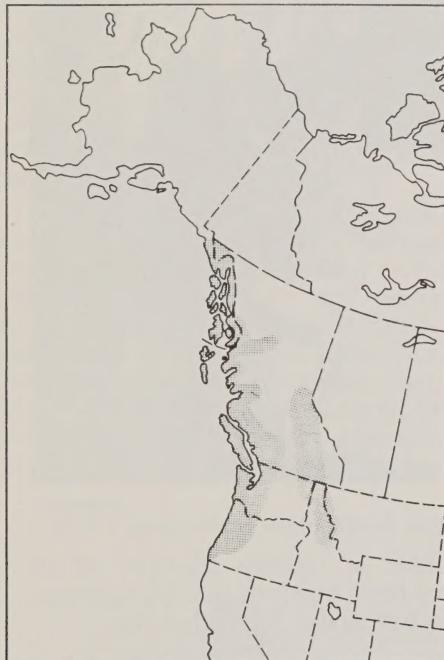


Figure 1.—Distribution of the hemlock sawfly in western North America.

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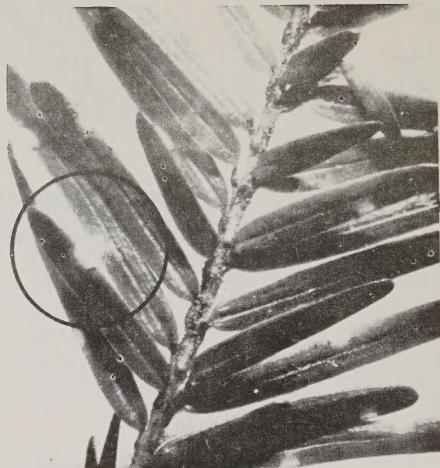


Figure 2.—Hemlock sawfly larvae and characteristic feeding damage to western hemlock.

appear thin and gray. If defoliation occurs for two or more successive years, the trees are weakened and may die or succumb later to other insects or diseases. During sawfly outbreaks, many cocoons can be seen on twigs, foliage, and underbrush and on the forest floor.

#### Description

The freshly laid egg is pale yellowish white, oval, and nearly transparent (fig. 3). Just before hatching, it becomes yellow and swollen. The newly emerged larva is nearly black but later its body turns dark green. When the larva is nearly full grown, longitudinal stripes appear (fig. 4). The dominant color of mature larvae varies from green to yellow green, but the color of a few larvae may be



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Figure 3.—Eggs on hemlock needles ( $\times 1\frac{1}{2}$ ).



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Figure 4.—Hemlock sawfly larvae ( $\times 1\frac{1}{2}$ ).  
shades of orange. Larvae of all ages have black heads. Mature larvae are about  $\frac{3}{4}$  inch long.

The sawfly cocoon is cylindrical with bluntly rounded ends (fig. 5), light brown to dark golden brown, tough, papery, and textured. The cocoons are from  $\frac{1}{4}$  to  $\frac{3}{8}$  inch long, the cocoon of the female being larger than that of the male. The adult sawflies are



Figure 5.—Hemlock sawfly cocoon (much enlarged).

yellow brown to dark brown and have brown or black antennae. They are about  $\frac{1}{4}$  inch long. The antennae of the female are thread-like (fig. 6A), and those of the male are feathery (fig. 6B).

#### Life History and Habits

The hemlock sawfly generally completes one generation per year, but some individuals remain in extended diapause as prepupae, taking two or more years to complete the life cycle. The sawfly overwinters in the egg stage, and eggs hatch in early June.

The young larvae feed in colonies on old foliage. As larvae mature, they disperse. Many individuals feed singly, but some loose colonies remain until pupation. Male sawfly larvae have four feeding instars and females, five. Mature larvae often move about in the tree crowns and may also migrate up or down tree trunks be-

fore pupating. Although no more than one generation occurs annually, larvae of various sizes can be found from late June through August.

After feeding is completed, the larvae enter a nonfeeding or prepupal stage in which the body becomes foreshortened. The prepupae then spin cocoons wherever they rest after feeding—in the duff, on understory shrubs, or on twigs and needles of the host tree. Bare twigs in the lower crowns of hemlock trees are common pupation sites. Adult sawflies emerge from the cocoons from August through October, males normally emerging earlier than females.

The eggs are deposited in slits cut by the female along the edge of hemlock needles. Usually the female deposits only one egg in a needle, but occasionally she deposits two or more. Each female deposits, on the average, about 72 eggs, but the number varies from 20 to over 100, depending on the size and vigor of individuals in the population. The current year's foliage is preferred for egg laying.

#### Natural Control

Insect parasites, fungous diseases, and adverse weather can help to control the sawfly. A fungus (*Entomophthora* sp.) has

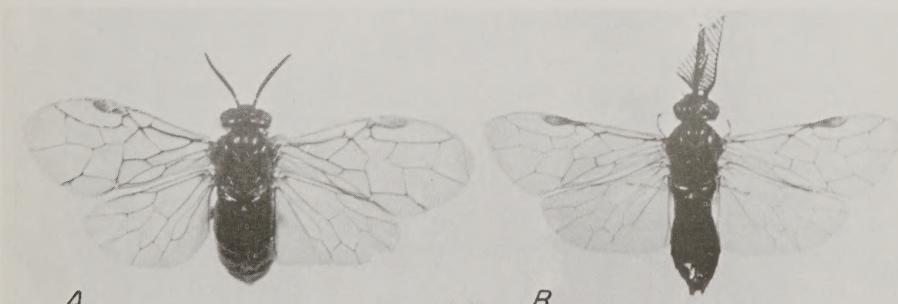


Figure 6.—Adults ( $\times 4\frac{1}{2}$ ): A, Female; and B, male.

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been recovered from dead sawflies following abrupt population declines in Alaska. Starvation and poor nutrition caused by the depletion of old foliage may also contribute to population reductions. Several parasitic wasps attack the sawfly; three important ones are *Opidinus tsugae tsugae* Cushman, *Itoplectis quadricingulatus* Provancher, and *Delomerista japonica diprionis* Cushman.

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